

so severe as to require packing. On incising the dura much free blood escaped, revealing a complete separation of the cord for a distance of one and a half inches. The 10th dorsal vertebra was freely movable. Packing was required to control the hemorrhage. The dura was left unclosed. A drain was inserted and the wound closed by the usual method.

The symptoms in this case from the outset were those of complete cord lesion, but in laminectomy lay the only possible chance for relief. An attempt to suture the cord, or to unite the roots above and below the lesion, was rendered impossible by the extensive hemorrhage.

Death occurred on the twentieth day, this patient having also developed cystitis following unwise catheterization.

CASE X.—The importance of accurate localization of the lesion and its difficulty in the absence of definite symptoms, especially in children, is well shown by the following case:

J. B., a child, aged seven years, suffered a fall, which showed no deformity of the spine, but caused complete paralysis of the legs and sphincter. Laminectomy done two days later over the 6th and 7th dorsal vertebrae showed no lesion of the cord. Seen by me seven months later the paralysis of the legs and sphincters had persisted in great part. The lesion was localized over the 3d dorsal vertebra. Laminectomy at this point showed slight thickening of the laminae. Many adhesions between the cord and meninges, the large amount of fluid in the meshes of the adhesions giving it a cystic appearance and much yellowish scar tissue present (old hemorrhage). There has been, as was to be expected from the conditions found at operation, no improvement in this case, nine months after operation.

Early operation at the proper site would have removed the blood, offset the effects of the edema, and would doubtless have been of much benefit.

THE ETIOLOGY AND PREVENTION OF TUBERCULOSIS FROM THE SOCIOLOGICAL POINTS OF VIEW.

BY WILLIAM CHARLES WHITE, M.D.,

ASSOCIATE PROFESSOR OF MEDICINE, UNIVERSITY OF PITTSBURGH; MEDICAL DIRECTOR,
TUBERCULOSIS LEAGUE HOSPITAL.

THE etiology of tuberculosis has not yet been solved. For thirty-nine years, since the wonderful discovery of Koch, we have known that no tuberculosis exists without the tubercle bacillus. This one great truth has been established, but it is not all the truth, for it is just as salient to say there is no tuberculosis without the animal body. Even these two great factors do not close the discussion,

for some relation arises between the tubercle bacillus and the animal body, occasioned by their contact, which must attain before the essential feature of tuberculosis, the miliary tubercle, is formed.

THE TUBERCLE BACILLUS. From the time of the isolation of the tubercle bacillus by Koch, it has been studied in many ways. We know in part its form, singly and in colonies, its varieties, its chemical reactions and chemical compositions, its necessary food and environment, its excretions and enzymes, its life history, in glass and as a parasite, its resistance to light, to heat, and to chemicals, but not yet the one essential factor, why and how it produces a tubercle.

THE ANIMAL BODY. The study of the tubercle bacillus outside the body has been comparatively easy. The organism is, however, lost when we put it within the animal body. We know it soon enters a phagocyte cell, probably chiefly one of endothelial origin, but once inside of this cell, there begins a series of chemical and physiological changes, wholly obscure to us as yet. After some days, however, we see the evidence in the miliary tubercle, of the busy life it has led, marshaling against it at least three different armies of cells: polynuclear leukocytes, endothelial cells, and lymphocytes.

It is not surprising that our knowledge of etiology as it relates to the animal body is limited, for if we seek to reduce our size to that of a tubercle bacillus, retain our mentality, and start a wandering journey within the animal body we are soon lost in a maze of possible resting places. Before starting on such a journey we have the choice of several portals of entry, each leading to an environment in different organs and tissues of widely varying chemical structure. We see a chance of destroying sight with almost instant discovery, by establishing a solitary tubercle in the optic nerve, as opposed to the chance of establishing many thousands of tubercles, without discovery, within the lungs, or in a hidden lymph gland. But such choice of a final resting place is destroyed by the obstacles we meet on our journey, a blood current to carry us here or there, a wandering cell to transport us, a fixed cell to engulf us, an inimical fluid to dissolve us, it is small wonder all the truth has not yet dawned.

Our difficulties grow when we realize that we are just establishing our first firm basis for accurate physiological and chemical study of the animal body. Through the efforts of Fischer, Hoppe-Seyler, Folin, Mendel, Starling and many others we have realized that, first, an equilibrium must be established for the animal body, and, after this, an intake of known composition be added before resultant compounds can be determined. It is not strange when this knowledge is so meager that we have not discovered under what chemical condition of the body the tubercle bacillus can flourish.

INVESTIGATOR AND INVESTIGATION. One of our best students has recently said to me, "If I had the opportunity to study tuber-

culosis I would not know where to begin; it is like battling against the waves of the ocean." It is not so bad as this, however; what we need is a new grasp of our problem on a broader basis. The crux of the problem is the relation existing between the tubercle bacillus and the animal body.

New problems for research are opened to us daily by the surgeon, the anatomist, the physiologist, and the chemist, and probably many of these must be solved before the true etiological factors are apparent and relief from our suffering from this disease attained.

PRESSING PROBLEMS. Such problems are involved in the answers to the following questions:

Why does the tubercle bacillus select the apices of the upper lobes of the lungs in man and the cephalic ends of the caudal lobes in cattle?

What is the relation of small doses of tubercle bacilli from various sources to later immunity and a reduction of morbidity and mortality?

What is the relation of early localized lymph glandular lesions to later more generalized tuberculosis, ranging from early lesions in the lungs to general miliary tuberculosis?

What is the chance of reaching the tubercle bacilli lying within tubercles in the body of an animal by chemicals introduced into the blood stream, and what hope does such study hold out of cure or arrest of the process?

What bearing has the physiology of various organs, such as the spleen, on the general problem of immunity to tuberculosis?

What hope have we of establishing immunity by vaccination or arrest and cure by immune sera? and so on, a host of unanswered questions bearing directly on our relief from the stand-point of control by social measures.

If we choose the lung as the chief point of attack in the animal body as the object of our study, we are conscious at once of a chemical factory to which every organ and tissue sends its contributions, through veins, lymphatic vessels and thoracic duct, contributions which vary all the way from the internal secretion of the adrenal glands to the neutral fats, changed by the lining membrane of the bowel and transported by the lymphatic channels from the food in the intestine.

Any one of these substances may contain the solution of the secret of the choice of this organ by this widely distributed bacillus.

If we seek to solve the question why tuberculosis attacks the apex of the upper lobe in man, one can see how complex even this question is when the following explanations of it are available for study.

1. That it may be due to mechanical pressure from rib and clavicle producing a quiet area; this, of course, is not applicable to the place of choice of the bovine lesion in the caudal lobes.

2. There may be a peculiar chemistry of the apices of the lungs in these two animals dependent upon position and directness of the blood stream or other similar factor, determining a peculiar quality of fluid or cell in this region.

3. There may be some peculiar anatomical relation existing between the portal of entry, the lymphatic glandular system, and various arteries which, by directness of stream and current, carry tubercle bacilli once entering the blood to these regions.

4. There may be some anatomical relation between the lymphatic system and these regions which carries to them tubercle bacilli entering the lymphatics.

Let me point out again the difficulties by taking the latter as an example. Only within one year has there been any accurate knowledge of the lymphatics of the lung and their relation to the intestinal lymphatics, and yet there seems much of evidence to prove that the tubercle bacillus has some definite relation to the endothelial cells of this vascular system.

These problems may be solved for us by the chemist, the physiologist, the surgeon, or by all combined.

What we especially need are funds and facilities to provide the opportunity for research and research workers to take up these problems.

THE SOCIAL AGENT. Our lack of specific knowledge can in no way be offered as an excuse for laxity in putting in operation the knowledge we already possess. Our various organizations (from national to local), the most efficient ever established against a single disease, stand as evidence that we have not shirked our duty.

Perhaps, however, our wisdom has not always been as prominent as our energy, and mainly we have failed to realize that our most efficient agents must always be doctors and nurses with a social sense. These alone can combine skill in diagnosis and treatment, with a knowledge of social conditions which underlie the spread of this disease.

One of the most disturbing features of modern work has been the gradual loss of respect for medicine and nursing as professions. This has become especially marked in tuberculosis work, where, with the establishment of laboratories, new agents of social service, and executive secretaries of organizations, the curious condition has arisen that there is a wide-spread opinion that little skill is necessary for the diagnosing and provision of consumptive people. There is scarcely a city or State today in which a layman operating as secretary or agent of a society for the prevention of tuberculosis is not able to both get the sputum analyzed and the patient placed in a hospital without ever having to see a doctor.

I often wonder whether our whole flimsy construction of medical and nursing training is not at fault when it is possible for laymen and laywomen to do the work which our present long course of training leading to degrees, licenses, doctors, and nurses to do.

Two great facts for some years have steadily robbed the race of the assistance of these two groups: (1) the exclusion of tuberculosis from the institutions of general professional training, and (2) the establishment of special institutions in territory inaccessible to students of these two great professions.

A new and healthy movement in America has lately been evidenced by the work of the Tuberculosis League in Pittsburgh, the Phipps Institute in Philadelphia, and Jefferson Medical College, in connection with the schools to which they are attached, in demanding practical experience in this work as part of the prescribed course.

I am convinced that the single factor of making the practical education of tuberculosis, from the stand-point of diagnosis, treatment, and social aspect, a demand of the prescribed courses for doctors and nurses in the institutions where they are trained will do more in five years to reduce the morbidity and mortality from this disease than all the special institutions for its care that we have been at such pains to establish.

THE SOCIAL FABRIC. How much of tuberculosis is closely bound up with our houses, our schools, our food, our workshops, our means of transportation, our dusty streets, our wages, our poverty, and with disease other than that caused by the tubercle bacillus, cannot yet be answered completely and finally. We know enough, however, to make these relations part of the education of our whole population.

For such education three great sources are always open to us:

The first and most important—the schools—is most likely to succeed because of the legal backing which makes listening and teaching compulsory.

The second, the pulpit. I never attempt a special lecture on this subject that my effort does not sink into insignificance beside those of my friends and coworkers in my own community. For instance, when Rabbi Levy, with his wonderful conception of the Fatherhood of God; Bishop Canevin, with his great and good paternalism; and Dr. McIlvaine, with his fearless and loving admonition, and many others, join on a chosen Sunday each year in teaching the truths of this great problem to their congregations I realize that a force for education has joined the ranks of our special organizations the world over that marks a most powerful ally in the direction of universal education of this subject.

The third great agent of education is the daily paper. I think all who know must feel disappointment with the help of these powerful agents. I suppose their sin is wrapped up with the fact that their papers must be sold. The selling agent is news, and not the reiteration so essential to education; but every once in a while the entrance of tuberculosis to the family of the throne room of the paper brings forth a new ally of wonderful power.

The essential feature of such education, however, must be truth. Each day reveals new evidences of sadness resulting from careless statements which lead only to fear and bring the suffering of the outcast to the consumptive populace.

The standardization each year of knowledge through some central office, like the Federal Government or the National Association, would tend to lessen the dangers of each successive period of advance.

CORRELATED MOVEMENTS. Next to education there is not a movement for the health and welfare of the race which has not had its share in reducing this sickness—housing reform, child welfare, pure water, better wages, pure food, health laws, school lunches, ventilation, food lines—all aid.

I often wish to each might be given the credit for all it has contributed to the present great reduction in tuberculosis, for I sometimes fear that in our enthusiasm we have claimed too much and been misled by the establishment of institutions which, while necessary for housing this excluded portion of the race, have largely failed to rise above mere housing institutions and have neglected that perhaps more important foundation, provision for specific research in this work.

Perhaps one of the most striking conditions of modern municipalities is the large number of small charitable institutions, each with laundry, kitchen, bakeshop, purchasing department, engineering department, and high-priced superintendent and officers, to which the whole public gives more or less lavishly without any thought for economic and careful use of their funds. There ought to be some place, a legal authority, to stop such waste and carelessness and establish a central department, including laundry, kitchen, storehouse, and other such necessities for these smaller institutions for each community.

Many interesting social studies by Federal, State, and local organizations have been made. Among these are the housing surveys by Dr. Biggs in New York, the study of the children of the tuberculous, as compared with the children of the non-tuberculous and many others which need confirmation, with the eradication often of sources of error in the comparison of results which arise because of variation in technic.

DIVISION OF LABOR. With such a universal problem and so great a host of agents entering into its solution, perhaps the two outstanding demands of this work are uniformity and equitable division of the labor.

To what end is all our labor if one class is helped and another neglected; if one State is efficient and another lax; if one race is protected and another left to exposure?

As it appears today the poor receive a large percentage of our beneficence while the great middle class suffers for its independence

by our neglect, and the rich wander from climate to climate and doctor to doctor, hoping that God in His goodness has vouchsafed some knowledge for their benefit which can be purchased with gold and silver to the exclusion of the rest of the world.

Or, again, one State provides lavishly for this one feature of public health while a neighboring State, separated from it by an imaginary line, turns its back upon its duty; or one town attempts efficient handling of its problem while a nearby borough does nothing. The source of such discrepancies, of course, lies where the law originates in the State and Federal Government.

RELATION TO OTHER HEALTH MOVEMENTS. When such a law is at last prescribed we are apt to make again the mistake of separating tuberculosis from other health and charitable activities, and so waste a great part of the efforts of our agents by reason of a duplication of labor.

THE SOLUTION. I am more and more convinced of the soundness of the solution for this problem which I have offered on more than one occasion, and inasmuch as I believe in it so fully, I am to be guilty of proposing it again to you.

This plan is based on a study of our solution of a similar universal problem presented by our educational demands.

Emanating from State law there is in general established in educational work a unit equipment for a unit of population. By this equipment is gained a uniform compulsory and intensive application of the law to all concerned. The money for the expense of this care is provided by State and local taxation, determined largely by the density of population and the need of the community. Those who are interested in this phase of the question would do well to read Cubberly's *Problems of State and Municipal Education*.

In the educational field there has gradually developed a knowledge of the equipment necessary for a given population, and this equipment has been apportioned so as to be easily accessible by those whom it is to serve. The management of these units is centered in a legally constituted governing body, which also controls the expenditure of the funds collected by taxation.

The same form of control is applicable throughout to tuberculosis and other health problems.

In the first place, our statistical studies have given us fairly accurate knowledge of where to place our equipment and of what the equipment should consist.

I should say that for each hundred thousand population there should be a hospital of 200 beds, a dispensary and an open air school. There should be fifteen nurses, of whom five are visiting social service nurses and four or five physicians. Such an equipment might easily expand and include all public activities, child welfare, pneumonia, syphilis and other health and public welfare problems.

The expense should be borne as the educational expense is borne, and the demand made mandatory by state law.

Large centers of population would be looked on as but the multiplication of units of 100,000, and the equipment would be multiplied accordingly, just as we now multiply our school equipment. Each unit would be self-governing, but centralized in some central governing board which would establish the uniformity of the work and the prevention of overlapping.

The State that sees fit to establish such a principle will, it seems to me, soonest reach the land of heart's desire, and will have a machinery as elastic as the problems to be dealt with, a machinery that can grow as knowledge grows and retract or reconstruct as necessity decreases, a machinery that can be used as a teaching center for doctors, nurses, and social agents, and the sooner it comes, the sooner will we see spelled on the wall the doom of our present boarding houses for sick and well consumptives, and waste of effort.

THE RELATION OF TUBERCULOSIS OF THE BRONCHIAL GLANDS TO THE DIAGNOSIS AND TREATMENT OF TUBERCULOSIS OF THE LUNGS.

BY MARY E. LAPHAM, M.D.,

HIGHLANDS CAMP SANATORIUM, HIGHLANDS, NORTH CAROLINA.

It is beginning to seem more than probable that the first chapter in the story of tuberculosis of the lungs is often written in the bronchial glands, and that if this chapter could be discovered and understood as it is being written in the bronchial glands, that we might prevent the writing of the future chapters in the lungs. This is strongly suggested in those cases characterized by the prodromes of tuberculosis which cannot be confirmed by physical examinations of the lungs: the "pretuberculous cases"—what the French have called "tuberculizable"—cases seeking an examination because there is a history of tuberculosis in the family, or a cough, or the syndrome of tuberculous toxemia. It is precisely in these suspicious cases, when we are unable to find any evidence of tuberculosis of the lungs, that we should remember that all these suspicious prodromes may come from the bronchial glands, and that our search for tuberculous processes is only half-made when we stop with the lungs and do not include the bronchial glands.

Cases of tuberculosis of the bronchial glands without physical signs of tuberculosis of the lungs are dangerous, because they may at any time prove fatal by perforating the trachea, bronchi, esophagus, or bloodvessels, by inducing pathological changes in the lungs